OIL AND GAS EXPLORATION AND PRODUCTION

The domestic oil and gas industry produces approximately 40 percent of the energy used in the United States. Some of the largest US oil and gas reserves are located beneath sensitive or one-of-a-kind environments such as arctic regions and tropical marine habitats with unique geology, climate, hydrology, vegetation, and wildlife. Because of their proximity to sensitive or unique areas, some oil and gas reserves are found in or near parks.

Potential environmental impacts from oil and gas exploration and extraction include destruction or alteration of wildlife habitat; erosion; sedimentation; pollutant loading of ground water and surface water from product leaks and spills; ground water contamination from production or waste injection zones; release of hydrocarbons or hydrogen sulfide to the atmosphere; and decreased soil productivity or releases from reserve/mud pits.

Auditor's Guidelines:

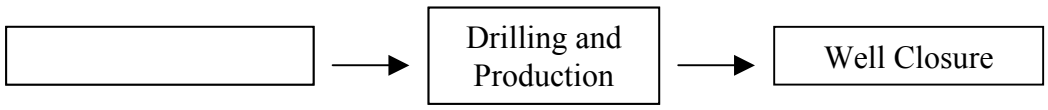
Records to Review
- Operational plans of oil and gas operators
- Park inventory of oil and gas wells
- Park inspection and monitoring records
- Park procedures for responding to environmental impacts of oil and gas operations

Features to Observe
- Wells
- Oil storage areas
- Containment areas

Persons to Contact
- Natural resource specialist
- Park liaison between facility and operators
- Field rangers
- Superintendent

OIL AND GAS PRODUCTION PROCESSES

Oil and gas development typically progresses through several stages, from exploration, to development, exploitation, and decommissioning. The direct and indirect effects of oil and gas development on the environment depend on the development stage.



Prospecting

Initial prospecting using remote sensors may have minimal environmental impacts; however, subsequent seismic surveys can cause surface scarring and loss of habitat due to traffic and land clearing.

Drilling and Production

Exploratory drilling for oil deposits has the potential to impact the environment through product or waste spills, road construction, wastewater discharges, and waste disposal. Development of a production field requires access to, or construction of, infrastructure that includes roads, pipelines, power lines, temporary housing, and drilling facilities. Increased infrastructure can lead to increased sedimentation in surface waters from erosion and may be subject to Storm Water requirements (see Storm Water EnviroCheck Sheet). Spills and contaminated water discharged from drilling operations can cause significant impacts on human health and the environment if not managed in accordance with Emergency Response and Reporting requirements (see Emergency Planning and Reporting EnviroCheck Sheet). Air quality can also be impacted from gas flares and pump sprays that release organic compounds into the atmosphere (see Air Quality EnviroCheck Sheet).

Well Closure

During the decommission phase, wells and associated infrastructure are abandoned, leaving scarred lands unless they are re-vegetated. If improperly plugged, abandoned wells provide a potential conduit for surface contamination to reach drinking water aquifers.

DEFINITIONS

Commercial vehicle: Any motorized equipment used in direct or indirect support of operations.

Gas: Any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperature and pressure conditions.

NORM: Naturally Occurring Radioactive Material.

Oil: Any viscous combustible liquid hydrocarbon, or solid hydrocarbon substance easily liquifiable on warming, which occurs naturally in the earth, including drip gasoline or other natural condensates recovered from gas without resort to manufacturing processes.

Operator: A person conducting or proposing to conduct operations.

Superintendent: The Superintendent, or his designee, of the unit of the National Park System containing lands subject to the rights covered by these regulations.

LEGAL REQUIREMENTS

Federal

NPS Regulatory Requirements (36 CFR 9)
Non-federal oil and gas production on National Park Service (NPS) lands and waters are regulated under 36 CFR 9, Subpart B. They are designed to prevent or minimize damage to the environment, and to ensure that the National Park Service is left unimpaired.

Other Applicable Federal Regulations
The operator must comply with all other applicable federal and state regulations. Some of the most uniquely relevant are the following:

- The Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) requires that facilities discharging to waters of the state maintain a NPDES permit limiting the amount of pollutants discharged.
- The Clean Air Act (CAA) regulates sulfur, NO_x, and volatile organic compound emissions. Under 40 CFR 60, if an operation uses fuel-burning equipment with heat input of 250 MBtu/hour or higher, documentation of emission monitoring must be maintained by the operator.
- The Resource Conservation and Recovery Act (RCRA) requires the proper management, transport, storage, and disposal of hazardous waste generated from all production processes, including oil and gas operations.

State

Certain state regulations may be more stringent than federal requirements. State regulations must be reviewed to assess compliance status.

COMPLIANCE REQUIREMENTS

Regulations under 36 CFR 9, Subpart B include the following restrictions:
Access. No operator may conduct oil and gas exploration or development without a Plan of Operations approved by the NPS, unless they have a valid access permit or a special use permit.

Plan of Operations. To be approved, the Plan of Operations must include at least the following information as appropriate:

- The names and legal addresses of the operator and the owner or lessee;
- Copy of the lease, deed, designation of operator, or assignment of rights;
- A map showing the perimeter of the operations area;
- A map showing the location of existing and proposed access roads to the site; the boundaries of proposed surface disturbance; the location of proposed drilling; location and description of all surface facilities including sumps, reserve pits and ponds; location of tank batteries, production facilities and transmission lines; well-site layout; sources of construction materials such as fill; the location of ancillary facilities such as camps, sanitary facilities, water supplies, disposal facilities, and airstrips;
- A description of equipment to be used in the operations;
- An estimated timetable for operation completion;
- The geologic name of surface formations;
- The proposed drilling depth and the estimated tops of important geologic markers;
- The estimated depths at which water, brines, oil, gas, or other mineral bearing formations are expected to be encountered;
- The nature and extent of the known deposit or reservoir to be produced and a description of the proposed operations;
- A breakdown of the estimated costs to be incurred during the implementation;
- Methods for disposal of all rubbish and other solid and liquid wastes; and
- An affidavit stating that the planned operations comply with all applicable federal, state, and local laws and regulations.

Use of water. No operator may use water from a point of diversion within the boundaries of the park unless it can be shown that removal of the water will not damage park resources. Removal of water must comply with appropriate state water laws.

Reclamation. Upon completion of extraction operations, the operator must remove or neutralize any contaminating substances, and rehabilitate the area to its natural conditions.

Operating Standards. The operator must maintain the site in a safe and workmanlike manner, having due regard for the preservation of the environment. The operator must take reasonable steps to remove accumulations of oil or other materials. Other standard operating requirements include; appropriate clearance, surveys, temporary well closure, proper marking, and fencing.

Recordkeeping. Technical data, including daily drilling reports and geological reports, which are submitted to the state or to any other bureau or agency of the federal government, must be available for inspection.

Wild Wells. The operator must take all technologically feasible precautions to prevent any oil, gas, or water well from blowing open or becoming "wild." and must take immediate steps and exercise due diligence to bring under control any "wild" well, or burning oil or gas well.

Waste Handling. Oil field brine, and all other waste and contaminating substances must be kept in the smallest practicable area and must be confined so as to prevent escape as a result of percolation, rain, high water, or other causes.

Accidents and Fires. The operator must take technologically feasible precautions to prevent accidents and fires, must notify the Superintendent within 24 hours of all accidents involving serious personal injury or death, or fires on the site, and must submit a full written report within 90 days.

Cultural Resource Protection. The operator must not injure, alter, destroy, or collect any structure, object, or other value of historical, archeological, or other cultural importance. Once approved operations have commenced, the operator must immediately bring to the attention of the Superintendent any cultural or scientific resource encountered.

Commercial Vehicles. No commercial vehicle must use roads administered by the NPS without being registered with the Superintendent. Roads must be used in accordance with procedures outlined in an approved Plan of Operations.

POLLUTION PREVENTION AND WASTE MINIMIZATION

Siting

Oil and gas exploration and production sites are situated near petroleum-bearing formations. Such formations may be located in nearly any climate and topographical setting and may be either distant from or near population centers. Siting considerations should include the possible impacts of operations (such as platform construction, NPDES discharges, tankering, air emissions, and spills) on marine mammals, birds, fish, and benthic organisms; avoid siting near waterways when possible.

Site access roads, haul roads, product treatment facilities, and disposal facilities should be located to minimize the effects on sensitive ecosystems; erosion controls (see Storm Water Management EnviroCheck Sheet) should be implemented (required if greater than 1 acre is disturbed).

Directional drilling should be employed to reduce impacts in sensitive areas. Directional drilling places the bottom of the well under an inaccessible surface location (e.g., under a river, lake, city, or other occupied place) where vertical drilling is impractical or undesirable.

Exploration

Oil and gas exploration includes all activities from geophysical exploration for petroleum deposits to wildcat well drilling and production well drilling and installation. Such activities involve site clearing and preparation, the installation of mud pits and reserve pits, construction of the drilling pad and ancillary facilities, and operation of the drilling rig. Following are additional issues of relevance to exploration:

- The drill site preparation plan should include the construction of diversion ditches and containment berms to reduce site run-on and prevent release of contaminated runoff.
- Closed mud systems should be used to reduce land disturbance and decrease the chances for mud releases been considered.
- Separation systems for filters and solids should be employed to increase the lifetime of drilling muds, thereby reducing the total quantity of muds to be employed.
- Mud additives of known or suspected hazard should be replaced with less toxic additives.
- Reserve and mud pits should be constructed to contain total expected mud column volumes plus rainfall and include adequate freeboard to minimize chances of pit overtopping.
- Reserve and mud pits should be constructed with impermeable liner materials to prevent the downward migration of fluid constituents.
- Surface casings should be installed to a depth below the deepest Underground Source of Drinking Water (USDW).
- Cement job specifications should be established to ensure the protection of ground water resources.
- Drilling plans should call for squeezing fresh water sands with cement while drilling to inhibit the migration of contaminants into the USDW and inhibit groundwater draw down.
- Site preparation and drilling activities should be timed to avoid disturbing plants and animals during crucial seasons in their life cycles.

Lease Development and Production

Oil and gas production typically begins with well completion (preparing the well to allow formation fluids to flow into the bore) and extends through primary production (produced fluids enter the well without the addition of mechanical energy) and secondary production (some external "lift" is applied to force formation fluids into the bore and to the surface, such as water flooding). Production activities include all onsite treatment of produced fluids, including phase separations (solids removal, produced water separation, and gas phase and liquid phase separation), emulsion cracking, sweetening and dehydration, and compression, as well as equipment maintenance activities, such as workovers and completions, pipeline pigging, storage tank bottoms removal, pit skimming and closure, and the injection of produced fluids.

The following elements should also be considered during the development and production stage:

- The operator's spill prevention and response plan should include the installation of secondary containment for all aboveground storage tanks and vessels.
- Produced water pits/tanks should include oil-skimming capability to increase product recovery and reduce the toxicity of the produced water.
- Site dehydration and sweetening unit systems should include efficient filtration systems to reduce the degradation of these materials.

- The site operation should include installation of a sulfur recovery system from the production stream. A tail gas scrubber should be installed to further increase total sulfur recovery. Sulfur recovery at oil and gas projects now represents more than 50 percent of domestic elemental sulfur production.
- The operator should replace formaldehyde-based sweetening solvents with less toxic alternatives if possible.
- The operator should utilize the services of amine and/or glycol reclaimers to extend the useful life of these materials and reduce the quantity of used conditioning fluids.
- Production and injection wells should be installed with casing-head gas recovery systems to reduce emissions of hydrocarbons. Casing head gases and other gas wastes should be flared at high temperatures to reduce emissions of products of incomplete combustion.
- The operator should perform periodic well casing integrity tests to reduce the potential for the migration of fluids between production and freshwater zones.
- During secondary production, operation plans should include monitoring of production water percentage to alert the operator of any injection water or formation water migration so that remedial measures can be rapidly taken.
- Injection well tracer surveys, in conjunction with injection or disposal wells, should be conducted to reduce the potential for injected water/wastes going into drinking water aquifers. Temperature logs before and after injection may also be effective in determining whether unintended migration has occurred.
- Completion fluids should be managed separately from produced fluids.
- Monitoring systems should be installed for underground pipelines to prevent soil/groundwater contamination. Underground piping should be made of corrosion resistant materials or be protected using cathodic protection or other devices.

Waste Management

The pit management system should separate wastes of known or suspected hazard from non-hazardous wastes to reduce the total quantity of materials requiring special handling. Following are methods in which such separation can be accomplished:

- The operator should utilize the services of a crude oil reclaimer for reduction of the quantity of tank bottoms and oily debris requiring disposal. Product storage tanks should incorporate recirculation pumps to reduce the settling of heavy hydrocarbons on tank bottoms.
- The operator's waste minimization plan should include the use of drip pans for all treatment vessels, valves, and product pipeline junctions to reduce uncontrolled environmental releases. Drip pans should be inspected and emptied on a regular basis.
- Pit closure plans should call for de-watering mud and reserve pit contents before burial to reduce the chance of the downward transport of contaminants to aquifers.
- The grading of soils covering pits may reduce the chances of infiltration of rainwater, which may migrate to groundwater.
- NORM – Naturally Occurring Radioactive Material may exist at the same depths as oil and gas reservoirs. Technically Enhanced NORM (TENORM) may be inadvertently forced to the surface and released to the environment during the extraction of oil and gas and the discharge of brines and wastewater. The operator should take steps to prevent the spread of TENORM on NPS property.

FOR MORE INFORMATION

- 36 CFR 9 Subpart B. Regulations to control oil and gas activities within the NPS.
- American Petroleum Institute. May 1996. "Achieving Common Sense Environmental Regulation: Oil and Gas Exploration and Production." API, Washington, DC.
- American Petroleum Institute. January 1989. "API Environmental Guidance Document Onshore Solid Waste Management in Exploration and Production Operations." API, Washington, DC.
- American Petroleum Institute. November 1991. "Waste Minimization in the Petroleum Industry: A Compendium of Practices." API, Washington, DC.
- McCoy, Carol. National Park Service. March 31, 1998. "Court Upholds NPS Ability to Regulate Private Oil and Gas Development." NPS Geologic Resources Division, Natural Resource Program Center, Lakewood, CO.
- Society of Petroleum Engineers. March 1993. Proceedings of Society of Petroleum Engineers/EPA Exploration and Production Environmental Conference, San Antonio, TX.
- U.S. Environmental Protection Agency, Office of Federal Activities. "Pollution Prevention/Environmental Impact Reduction Checklist for Oil and Gas Projects." Undated.

*Note, questions in this check list relate to how the park is **overseeing** private oil and gas exploration and production of an operator—not conducting the operations themselves. Thus the regulatory citations apply to the **operator**, not the park. All priority 3 findings should be cited as "BMP related to …"*

Checklist Item	Priority	Notes
1. There are procedures to assure that each operator has an approved Plan of Operation with all required information, or other valid access permit or NPS special use permit. [BMP related to 36 CFR 9.36]	3	
2. Access is not granted on, across or through park property for oil and gas operations until an operator has filed a Plan of Operations and had the plan approved. [36 CFR 9.32(a)]	2	
3. There are procedures in place to assure that oil and gas operations that extract under park property do not occur until an owner has filed a Plan of Operations and had the plan approved. [BMP related to 36 CFR 9.32(e)]	3	
4. If operations pose an immediate threat of significant injury to federally owned or controlled lands or waters, the Superintendent requires the operator to suspend operations immediately until the threat is removed or remedied. The Superintendent notifies the operator within 5 days in writing of the reasons for the suspension and their right to appeal the suspension in writing. [36 CFR 9.33(c)]	1	
5. There are procedures to ensure that operators are not using water on NPS property without written approval from the Regional Director. [BMP related to 36 CFR 9.35]	3	
6. There are procedures to ensure operators: • Keep waste to the smallest practicable area, confined so as to prevent release and remove wastes as quickly as practical in a manner to prevent contamination, pollution, damage or injury to lands, water, vegetation, wildlife, or facilities. [BMP related to 36 CFR 9.45] • Prevent accidents and fires. [BMP related to 36 CFR 9.46] • Protect cultural, or historic resources [BMP related to 36 CFR 9.47]	3	
7. If the operator is discharging water from oil and gas operations to waters of the United States, park has determined that the operator has the appropriate NPDES permit. [BMP related to 40 CFR 122]	3	
8. There are procedures to monitor operators to ensure they are not causing environmental impacts to the park. [BMP]	3	

Checklist Item	Priority	Notes
9. There are procedures to ensure all closed wells have been properly closed so that they do not constitute a nuisance and do not adversely affect, injure, or damage NPS land or property, including: • Removal of aboveground equipment, structures and any other man-made debris; • Removing or neutralizing any contaminating substances; • Plugging and capping all nonproductive wells and filling dump holes, ditches, reserve pits, and excavations; • Grading the land as appropriate to the area; • Replacing natural topsoil; and • Reestablishing native vegetative communities; [BMP related to 36 CFR 9.39(a)(2)]	3	
10. There are procedures to ensure that the operator has other measures as necessary to provide for safe movement of native wildlife, reestablishment of native vegetative communities, normal flow of surface waters, reasonable flow of subsurface waters, and visitor use and safety. [BMP related to 36 CFR 9.39(b)]	3	
11. Unless specifically authorized by an approved Plan of Operation, the park ensures that no surface operations occur within 500 feet of: • The banks of perennial, intermittent, or ephemeral watercourses; • The high pool shoreline of natural or man-made impoundments; • The mean high tide line; • Any structure or facility used for interpretation, recreation; or park administration. [BMP related to 36 CFR 9.41(a)]	3	
12. There are procedures to ensure that whenever drilling or production is closed for 24 hours to 30 days, wells are properly shut. When operations are suspended for more than 30 days, a cap approved by the Superintendent is used. [BMP related to 36 CFR 9.41(c)]	3	
13. To protect visitors and wildlife, the park ensures that fences surround all existing and new wells and are of a design and material approved by the Superintendent that allow fire truck access. [BMP related to 36 CFR 9.41(e)]	3	
14. There are procedures to ensure all commercial vehicles using park roads are registered with the Superintendent. [BMP related to 36 CFR 9.50]	3	